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AMSAT NEWS SERVICE
ANS-220

The AMSAT News Service bulletins are a free, weekly news and information service of AMSAT, The Radio Amateur Satellite Corporation. ANS publishes news related to Amateur Radio in Space including reports on the activities of a worldwide group of Amateur Radio operators who share an active interest in designing, building, launching and communicating through analog and digital Amateur Radio satellites.

The news feed on http://www.amsat.org publishes news of Amateur Radio in Space as soon as our volunteers can post it.

Please send any amateur satellite news or reports to: ans-editor [at] amsat.org

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ANS-220 AMSAT News Service Weekly Bulletins

To: All RADIO AMATEURS
From: Radio Amateur Satellite Corporation
712 H Street NE, Suite 1653
Washington, DC 20002

DATE 2021 Aug 08

Debugging AO-109: An Update

Introduction

At the end of our article in the May/June AMSAT Journal, we said “By the time you read this, AO109 may be opened for general amateur use.” The opening announcement, in fact, came on July 19, just shortly after the Journal was available. Very shortly after that, we started getting reports that some SatNOGS stations had seen telemetry signal from AO-109 as early as May 2021. Chris, G0KLA managed to partially decode one frame from SatNOGS. It was hard work and there were too many errors for our Forward Error Correction algorithm to fix, but by ignoring errors, we could see some data; however we had to guess which data was wrong.

We asked for more people to try to get telemetry, and we were pleased to receive 29 frames over several days from W7KKE, W7FWF, and K8DP. Thanks so much to all of them! Thanks to them we can now say a few more things about

the AO-109 situation.

What we have seen and learned from telemetry

First the telemetry we have received confirms what we inferred from our earlier experiments:

• The antenna telemetry shows that they are open (more on that later)
• AO-109 is in transponder mode
• AO-109 does receive commands successfully, especially from a strong command station

In addition, telemetry shows some other anomalies that let us make better hypotheses for other behavior that we have seen.

• First the telemetry IS working, which tends to exonerate the telemetry modulator and software.
• The transmitter is sending telemetry with power output between 6 and 8 mW. You can compare this to our pre-launch testing which showed power output of somewhat over 100mW, as designed.
• The power amplifier current is higher than expected based on pre-launch testing.
• The min/max telemetry shows that the maximum power output since launch was about 440mW implying that the transmitter was likely working immediately after launch. (During the attempted early commissioning period, we tried both transponding, and increasing the telemetry gain, which could explain the relatively high power output.)
• It is even more clear seeing the telemetry downlink on a waterfall that the signal
strength varies cyclically. The period seems to be around 25 seconds.

After a discussion with Dan W9EQ, one of our transmitter engineers, we believe a reasonable hypothesis for the low power is that one of the dual power amplifier chips has failed shorted. This not only increases the current to the PA, but reduces the power available to the other PA chip. Dan also hypothesizes that running high power into a poorly deployed antenna might cause the blowout, although it is still hard to understand why we initially had no reception at all. Note that even if the 70cm antenna was not fully deployed, it does not cross over itself to make it electrically shorter even when stowed.

Since getting this telemetry, we commanded higher output from the telemetry modulator into the mixer and power amplifier, but saw essentially no change in the output power telemetry. According to W9EQ, this is to be expected with a shorted PA. (It may imply that 8mW is the highest to expect from the transponder as well).

As we hypothesized in the last paper, the cyclic strength of the telemetry beacon could be explained by the antenna being only partly released and blocked by the satellite part of the time as the satellite rotates. Similarly, if the receive antenna were only partly released, it would make commanding difficult for the same reason.

One further hypothesis: Carl, N3MIM proposed that the Nitinol wire used for our antennas was too cold to fully restore to its original shape after it was released. This could explain why both receive and transmit have problems, but does not explain why this satellite in particular should have problems that the other Foxes did not.

Vanderbilt University Experiment Data

As we said in the previous article, one of our goals is to provide data for the Vanderbilt University COTS radiation experiment. This experiment not only funded the AO-109 flight but also will, in the long term, provide

great information for satellite builders who can only afford common off-the-shelf parts in their birds. We are happy to say that we have been able to provide some data for Vanderbilt. Of course, more data over a longer period will be that much better, but at least Vanderbilt is getting something.

Where is the data?

The data from AO-109 is on AMSAT server at the same location as all Fox data. You can see the entire dataset by using FoxTelem and downloading Fox-1E (the latest versions of FoxTelem do not require you to download all the other satellites.) You will see that despite having only 29 frames, there are a lot more health records than that in the WOD tab. This is because of AO-109's new capability: Whole Orbit Data, which captures a full set of health data every 60 seconds, stores it in memory, and transmits several of these WOD data payloads in each frame. Similarly, Vanderbilt data is stored as WOD, so more science information than you might expect is also available.

In addition, you can see the AMSAT web page for AO-109 health at https://www.amsat.org/tlm/health.php?id=5&port=

Telemetry Reception

Unfortunately, it seems that it requires a fairly "hefty" station to receive AO-109 telemetry. A normal end-mounted M2 LEO Pack, for example, is not enough. Everyone we have seen who has been successful has had a longer yagi, a preamp, and short coax. One person felt that the ability to reverse circular polarity also helped. Several SatNOGS stations have received a signal, but so far we have not been able to cleanly decode any of them.

Both for Vanderbilt University and for our own engineering testing, we would really appreciate even a few frames of telemetry that any stations can receive. One way to do this is to use FoxTelem directly via a Fun Cube Dongle Pro Plus (FCDPP) and an antenna as mentioned above. Another way that we know works is to record the IF or AF from an ICOM 9700 that is being doppler corrected during an AO-109 pass. The best chance for useful frames may be to record IQ using SDR# or HDSDR with something like an FCDPP or Airspy SDR Dongle, and then playing it back into FoxTLM.

We continue to thank all of our supporters and data collectors around the world! Please keep trying!

[ANS thanks Burns Fisher, WB1FJ, AMSAT Flight Software, and Mark Hammond, N8MH, AMSAT Director and Command Station Operator, for the above information]

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As the battery condition is poor, please only use the satellite when it is illuminated by the sun. The satellite may shut off even while illuminated if the bus voltage drops below a point at which the transmitter cannot operator.

[ANS thanks Mark Hammond, N8MH, AMSAT Director and Command Station for the above information]

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Need new satellite antennas? Purchase Arrows, Alaskan Arrows,
and M2 LEO-Packs from the AMSAT Store. When you purchase through
AMSAT, a portion of the proceeds goes towards
Keeping Amateur Radio in Space.
https://amsat.org/product-category/hardware/

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VUCC Awards-Endorsements for August 1, 2021

Here are the endorsements and new VUCC Satellite Awards issued by the ARRL for the period July 1, 2021 through August 1, 2021. Congratulations to all those who made the list this month!

Congratulations to Michael McCoy KC9ELU on acheiving the AMSAT GridMaster.

CALL	July	August
KO4MA	1783	1786
N8RO	1096	1100
NS3L	697	702
K9UO	631	653
N9FN	550	561
AF5CC	525	547
MI6GTY	461	462
WA4HFN	413	454
S57NML	291	409
DL6IAN	154	335
EA2AA	280	314
KQ4DO	New	306
AB1OC	285	291
KE8RJU	101	256
NA1ME	225	250
N3CAL	204	214
N5EKO	152	207
KC5TT	100	135
WD9EWK (DM45)	127	135
W3FGP	100	130
K6SFO	New	129
KB3IAI	New	103
DL6GBM	New	100
KE4IP	New	100

If you find errors or omissions. please contact me off-list at <mycall>@<mycall>.com and I'll revise the announcement. This list was developed by comparing the ARRL .pdf listings for the two months. It's a visual comparison so omissions are possible. Apologies if your call was not mentioned. Thanks to all those who are roving to grids that are rarely on the birds. They are doing a lot of the work!

[ANS thanks Ron Parsons, W5RKN for the above information]

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AMSAT's GOLF Program is about getting back to higher orbits, and it all begins with GOLF-TEE – a technology demonstrator for deployable solar panels, propulsion, and attitude control, now manifested for launch on NASA's ELaNa 46 mission. Come along for the ride. The journey will be worth it!

https://tinyurl.com/ANS-GOLF

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2021. IL27, IL28, IL38
KE2QI: Will be roving FN44 Sunday. Both FM and linear. He will try to maximize the RS-44 apogee passes for Europe.
EN56, 57, 67: N8MR will be in EN57, EN67 and EN56 from Aug 7 thru Aug 14. Using an Icom 9700, Arrow antenna and SatPC32 to control uplink and downlink for Doppler.
EN12, EN13: W0AAE will be roving in the EN12-13 grids this upcoming week from August 1-6. He will be doing both linear and FM satellites
VE7KPM: CN78, upcoming. 9/2 approx.

Trans-Nevada Rove.

David AD7DB is planning a rove starting August 16 on FM satellites.

Mon 8/16 DM09 in Reno area.
Tue 8/17 DN00, DN10 & 11 later, near Lovelock and Winnemucca.
Wed 8/18 DN10, DN20 & 21 later, near Elko.
Thu 8/19 DN21, DN20 & 30 later, near Wells and Wendover.
Fri 8/20 DN20 and 30, near Wendover.
The actual satellite passes and times are still being worked out but plans are for AO-91, AO-92, SO-50, AO-27 and PO-101.
You can go to twitter.com/ad7db for the latest updates during the rove.

Wl7T - August 21-27:

BP44, BP45, BP46, BP47, BP54, BP55, BP57, BP58, BP59, BP64, BP65, BP75, BP84, BP85

[ANS thanks Paul Overn, KE0PBR, AMSAT rover page manager, for the above information]

Hamfests, Conventions, Maker Faires, and Other Events

AMSAT Ambassadors provide presentations, demonstrate communicating through amateur satellites, and host information tables at club meetings, hamfests, conventions, maker faires, and other events.

AMSAT Ambassador Clint Bradford, K6LCS, has online Zoom presentations scheduled in coming weeks with amateur groups in

New Jersey
Central New Hampshire
North Carolina
Conejo Valley CA
Sonoma County CA
Massachusetts
Antelope Valley CA

Contact Clint to arrange other events:
Clint Bradford K6LCS, AMSAT Ambassador; ARRL instructor
http://www.work-sat.com
Email: clintbradford AT mac DOT com
(909) 999-SATS (7287) - voicemail/message

[ANS thanks Paul Overn, KE0PBR, AMSAT Events page manager, for the above information]

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25% of the purchase price of each product goes
towards Keeping Amateur Radio in Space
https://www.zazzle.com/amsat_gear

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* Societies (a recognized group, clubs or organization).
* Primary and secondary school students are eligible for membership at one-half the standard yearly rate.
* Post-secondary school students enrolled in at least half time status shall be eligible for the student rate for a maximum of 6 post-secondary years in this status.
* Memberships are available for annual and lifetime terms.

Contact info [at] amsat.org for additional membership information.

73 and remember to help Keep Amateur Radio in Space!

This week's ANS Editor,

Paul Stoetzer, N8HM
n8hm at amsat dot org